

Lesson 1: Introduction to the Night Sky

Overview of Day and Night

Feet on the ground:

Set current time and place, use cardinal points (South centered)

Advance time to sunset and through the night to current time

(One day will not make a big difference later)

-Talking point: to ancient peoples, the sun, Moon and stars moved across the sky and disappeared until they returned the next morning or evening.

Pull away from Earth and look at Eastern PA landforms:

Atlantic Ocean, Delaware Bay, Appalachians, etc.

Back into space to look at the US and advance time to sunset

Watching the East Coast “light up”

Pull back farther to see the rotation of the Earth.

-Talking point: We now know the Earth spins around its axis – this is called rotation. The axis of the Earth is an imaginary line from the North Pole to the South Pole.

Return to the ground view with South centered. Time after sunset.

(winter ~5PM, Spring and fall ~7PM, Summer ~9PM ---may need adjusting)

Planet labels only turned on (not Uranus, Neptune, or any of the Plutoids)

also Moon label only

-Talking points: After the sunset, twilight lingers for about an hour until it gets dark enough to see most stars. In fact, the first “star” you see most nights will likely be a planet.

Younger students – have you ever said “star bright, star light, first star I see tonight”? You were likely wishing on a planet not the first star.

Older students – Twilight is the legal time when you need to turn on your headlights, but you’ll notice that it’s much easier to see cars that already have their lights on. Our eyes work better in daylight than at night (if you have students that have studied rods and cones, you can add that here).

Advance the time about an hour to remove the Sun's twilight glow.

All – our eyes take about 20 minutes to get used to the dark, so don't be impatient when you go outside to look for stars.

In winter, you will see more bright stars than any other time of the year. The constellation that nearly everyone has heard of is Orion, the hunter. Look for 3 bright stars in a row – this is his famous Belt. Now look for 4 bright stars forming a box around the Belt. The 2 stars above are Orion's shoulders, the 2 below, his feet or legs. You may notice that the star on his right shoulder is reddish and the one near his left foot is bluer. Stars have colors because they are different temperatures at their surfaces. Red stars are cooler than our Sun, blue ones are much hotter.

For older students you can go into more detail here if needed – see the Notes section.

Add Orion's picture Since we can't do this, use the laser pointer to show the Belt and point out the 4 stars around the Belt as shoulders and legs.

Using Orion's Belt, draw a line to his right until you come to a nice bright star – this is Sirius the Dog Star, the brightest star in our night time sky.

If you wish, see if any students have read Harry Potter, they will name Sirius Black, Harry's godfather, who could turn himself into a dog. You can add that they'll find lots of neat references to the night sky in the Harry Potter books, I usually add Bellatrix, the star on Orion's left shoulder, for Bellatrix LeStrange one of the Death eaters – see Notes at the end.

Sirius is the Dog's nose. You may be able to "connect the dots". Show that the Dog has a triangular head, 2 front feet, move to his back feet and his tail.

Add the Big Dog and the Small Dog (Canis Major and Canis Minor) Again, just point these out with your pointer. Moving above Sirius to a pair of stars, one fairly bright, the other dimmer. This is the whole constellation for the Small Dog which is why some call it "the Hot Dog".

Here are Orion's 2 hunting dogs.

Let's go back to Orion's Belt and go the other way. You will come to a nice V-shaped ice cream cone in the sky. The ancient Greeks did not have ice cream – this is Taurus the Bull

Add Taurus Point out the V-shape

(If you wish to add the Pleiades (also called the Seven Sister) sitting on Taurus's shoulder, you can talk about the pretty cluster of a bright star and 5-8 smaller stars, depending

on their eyesight. But mention that if they look at this cluster with a pair of binoculars or a small telescope, they'll be able to count 50-100 stars in that spot. You can also tell them they know the Japanese name for the group – Subaru – look at the symbol for Subaru – it's an oval with a big star and 5 smaller ones.)

If you draw a line from the blue star through the red star, you'll come to a rectangle of stars with 2 bright stars at the top. These 2 stars mark the heads of Castor and Pollux, the Gemini or Twins.

Add Gemini Point out the 2 bright stars that mark the heads of the Twins and draw stick men to show the constellation.

The final star and constellation in our huge asterism called the Winter Circle is Cappella the Baby Goat in the constellation the Charioteer.

Add Auriga Trace a pentagon of stars above Taurus. This is supposed to look like a man sitting holding a baby goat in his arms, to me it looks like a pentagon.

Now you can draw the Circle. Start with the red star in the center of the circle. Beginning with the blue star, move clockwise through Sirius, Procyon (the Little Dog Star), Castor, Pollux, Cappella, and end at Aldebaran, the eye of Taurus the Bull.

West: add the Great Square of Pegasus and Andromeda Trace the Great Square if it is visible in the west and the line from the top of the Square that is Andromeda.

The Fall constellations are still visible for awhile in the western sky.

East: add Leo the Lion Trace the backward question mark of Leo the Lion in the east.

In the east, we see the coming Spring constellations, here is Leo the Lion.

Be sure to point out any planets visible in the night sky. (Feb-Mar 2010: Venus would have been visible at sunset in the west—it will get higher in the western sky through Mar and Apr -- and Mars will be between Gemini and Leo)

(Point out Mars in between the Twins and the Lion). This is Mars. It will look at reddish at times. (Point out Venus in the west). Here is Venus. Venus will be the brightest object in the night sky for several months.

Pull back to see the Inner planets and their orbits (Mercury, Venus, Earth, and Mars)

As we travel away from Earth, we can take a trip through our Solar System. A solar system is a star and its planets, the moons orbiting those planets and any asteroids or other objects that orbit the star.

[Zoom into Mercury. You could also pull back to Mercury's orbit and then fly in to the planet.](#)

Here is the planet Mercury, the closest planet to the Sun and also the smallest of the major planets. (See Data sheet to decide what facts you want to use).

[Fly to Venus. Again, pull out to the orbit and then fly in.](#)

Venus is the second planet from the sun. (See Data sheet)

[Pull out to Earth.](#)

Earth is the third planet from the Sun. ([Notice the Moon??](#))

[Pull out to the orbit of Mars.](#)

Mars is the fourth planet from the Sun. (see Data sheet)

All of these 4 planets are similar. They are small rocky planets. They are also called the Terrestrial planets because they are similar to the Earth, known as Terra.

In between Mars and Jupiter lies the Asteroid Belt. This is a band of tiny rocky and metallic bodies that orbit the sun. The largest asteroid is Ceres. Ceres was discovered in 1801 and classified as a planet at that time. By the middle of that decade, more asteroids had been discovered and Ceres was demoted to just an asteroid. In 2006, Ceres was given the status "Dwarf Planet" because of its spherical shape.

[Add the orbit of Ceres and jump to Ceres to show its nice sphere.](#)

As we leave the Inner Solar System, the planets get farther apart in their orbits.

[Pull out to the orbit of Jupiter then jump to Jupiter view.](#)

Jupiter is the first of the Outer Planets. It is a giant ball of gas. (See Data sheet) Jupiter also has four faint rings around it as well as 63 moons.

[Pull out to Saturn and jump.](#)

Saturn is the last of our eye-visible planets. Saturn is famous for its rings, first drawn by Galileo when he saw them in that first little telescope. (See Data sheet) Saturn has 61 confirmed

moons, 2 possible moons and 150 moonlets. Its rings are 169,800 miles across but only 10 to 100 yards thick.

[Pull out to Uranus and jump.](#)

Uranus (pronounced YER-un-us) was discovered by William Herschel in 1781. He really wanted to name it after his patron, King George the Third of England, but the other astronomers and scientists insisted that he stay with the classical naming system so it was named for the father of Saturn and the grandfather of Jupiter. You will notice that Uranus has a nice ring system of 11 rings. It has 27 moons. (See Data sheet)

[Pull out to the orbit of Neptune and jump.](#)

Neptune was discovered in 1846. Neptune has six narrow rings and 13 moons. (See Data sheet) The four gas giant planets are called the Jovian planets (for Jupiter).

[Pull out to the orbit of Pluto and jump.](#)

When Pluto was discovered by American Clyde Tombaugh in 1930, it was thought to be about the size of Mercury, but in 1978, through a much better telescope, it was discovered that Pluto was really very small and had a very large moon. Here you can see Pluto and its moon Charon. This started a debate that is still going on. Should Pluto be classified as a planet, after all it is smaller than the Earth's moon. (See Data sheet) Pluto also has 2 smaller moons named Nix and Hydra.

[Pull out to Eris's orbit and jump.](#)

By 2006, many more small icy bodies were discovered in the region beyond Neptune's orbit, called the Kuiper Belt. At the meeting of the IAU (International Astronomical Union), Eris the largest of these bodies was designated a Dwarf Planet, along with Pluto and Ceres. Since then 2 more Dwarves have been added and the name of these outer dirty snowballs became Plutoids (like Pluto). (see Data sheet).

Beyond the Kuiper Belt is a region called the Oort Cloud.

[Pull all the way out to the Milky Way spiral.](#) The bright ring that appears as you pull away from the solar system is the Oort Cloud, then you should be able to see the spiral shape of our galaxy coming into view.

Our Milky Way Galaxy is a spiral galaxy and our Solar System sits out in one of the spiral arms. As we travel back to our Solar System far faster than the speed of light, we will pass the Oort Cloud, through the Kuiper Belt, pass the Plutoids, Neptune and Uranus. Let us pause at Saturn's largest moon Titan.

[Move back in until Saturn's orbit and jump to Titan.](#)

The Cassini Mission to Saturn carried a probe called Huygens that took a closer look at Titan and discovered not only a body with a deep and thick atmosphere and a surface covered by continents and oceans. The atmosphere and oceans are methane and ethane – on Earth natural gas – on cold Titan's surface the methane and ethane are actually liquids. Titan is larger than the planet Mercury and is the second largest moon in our solar system and the only one other than earth to have a substantial atmosphere.

[Move to Jupiter and jump to Ganymede.](#)

Ganymede is the largest moon in our solar system. It is larger than the planet Mercury and can be seen with the naked eye as it orbits Jupiter. Jupiter had 3 other very large moons and they are very different.

[Jump to Callisto.](#)

Callisto is the third largest moon in our solar system and Jupiter's second largest. It is about the size of Mercury. Callisto is composed of rock and ices. The bright patches on the surface turn out to be compounds of water ice, carbon dioxide, silicates, and organics. The Galileo spacecraft made investigations of the moon, and revealed that Callisto may have a subsurface ocean of liquid water more than 100 kilometers deep.

[Jump to Io.](#)

Io, the pizza moon, is Jupiter's 3rd largest and has over 400 active volcanoes. The Galileo spacecraft took pictures of erupting volcanoes. Io is the only other place in our solar system, besides the earth, to have active volcanoes. Io is larger than Earth's Moon.

[Jump to Europa.](#)

Europa is a little smaller than our Moon and is the six largest moon in the solar system. It appears to have a thin atmosphere of oxygen and the surface is very smooth and icy. Information sent back by the Galileo mission indicates that there is very likely a liquid ocean under the surface possibly kept warm by the gravitational pull of Jupiter. The cracks in some photos appear to be geysering liquid water which refreezes on the surface making this the smoothest world in our solar system. By comparison, if we could make a cue ball as large as Europa, the cue ball would have higher mountains.

[Jump to Mars and Phobos, then Deimos.](#)

Mars' moons are not round, they are small and more like baked potatoes. Phobos is larger, but only about 17 miles across. Deimos is much smaller, only about 7 ½ miles across. Scientists believe they are captured asteroids.

[Jump to our Moon.](#)

Here we are, back at our Moon, the fifth largest in the solar system. It is the only other place in the Solar System that people have walked on. Only 12 men have been on the surface of the Moon, beginning with Neil Armstrong in July of 1969.

Will we go back to the Moon one day? Will people walk on the surface of another planet? Will scientists discover life on another world?

[Jump back to feet on the ground, current day, after sunset.](#)

For now, we are here on the ground looking up. Perhaps one day one of you will lead the team that explores Mars or designs the rocket ship that allows us to travel fast enough to visit the stars.

[Fade to black and transition to a quiet video.](#)